



Published in final edited form as:

JAMA Pediatr. 2014 January ; 168(1): 76–82. doi:10.1001/jamapediatrics.2013.2752.

Barriers to Human Papillomavirus Vaccination Among US Adolescents:

A Systematic Review of the Literature

Dawn M. Holman, MPH,

Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Vicki Benard, PhD,

Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Katherine B. Roland, MPH,

Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Meg Watson, MPH,

Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Nicole Liddon, PhD, and

Division of Sexually Transmitted Disease Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention, Atlanta, Georgia

Shannon Stokley, MPH

Immunization Services Division, National Center for Immunization and Respiratory Disease, Centers for Disease Control and Prevention, Atlanta, Georgia (Stokley).

Abstract

IMPORTANCE—Since licensure of the human papillomavirus (HPV) vaccine in 2006, HPV vaccine coverage among US adolescents has increased but remains low compared with other recommended vaccines.

Corresponding Author: Dawn M. Holman, MPH, Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, 4770 Buford Hwy NE, Mailstop F-76, Atlanta, GA 30341, (dholman@cdc.gov).

Author Contributions: Ms Holman had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Holman, Benard, Roland, Watson, Stokley.

Acquisition of data: Holman.

Analysis and interpretation of data: All authors.

Drafting of the manuscript: All authors.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Watson, Holman.

Administrative, technical, or material support: Holman, Roland, Watson.

Conflict of Interest or Disclosures: None reported.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

OBJECTIVE—To systematically review the literature on barriers to HPV vaccination among US adolescents to inform future efforts to increase HPV vaccine coverage.

EVIDENCE REVIEW—We searched PubMed and previous review articles to identify original research articles describing barriers to HPV vaccine initiation and completion among US adolescents. Only articles reporting data collected in 2009 or later were included. Findings from 55 relevant articles were summarized by target populations: health care professionals, parents, underserved and disadvantaged populations, and males.

FINDINGS—Health care professionals cited financial concerns and parental attitudes and concerns as barriers to providing the HPV vaccine to patients. Parents often reported needing more information before vaccinating their children. Concerns about the vaccine's effect on sexual behavior, low perceived risk of HPV infection, social influences, irregular preventive care, and vaccine cost were also identified as potential barriers among parents. Some parents of sons reported not vaccinating their sons because of the perceived lack of direct benefit. Parents consistently cited health care professional recommendations as one of the most important factors in their decision to vaccinate their children.

CONCLUSIONS AND RELEVANCE—Continued efforts are needed to ensure that health care professionals and parents understand the importance of vaccinating adolescents before they become sexually active. Health care professionals may benefit from guidance on communicating HPV recommendations to patients and parents. Further efforts are also needed to reduce missed opportunities for HPV vaccination when adolescents interface with the health care system. Efforts to increase uptake should take into account the specific needs of subgroups within the population. Efforts that address system-level barriers to vaccination may help to increase overall HPV vaccine uptake.

Human papillomavirus (HPV) infection is common, with prevalence peaking among young adults.^{1,2} Most HPV infections clear within 1 to 2 years, but persistent infections can progress to precancers or cancer. Nearly all cervical cancers and many vulvar, vaginal, penile, anal, and oropharyngeal cancers are caused by persistent infection with oncogenic or high-risk HPV types.^{3,4} HPV-16 and HPV-18 are responsible for 70% of cervical cancers and most noncervical HPV-associated cancers.⁵ A recent study⁶ found that more than 40% of females aged 14 to 59 years were HPV positive, and nearly 30% of infections were with high-risk types. Approximately 26 200 cancers per year are attributable to HPV (17 400 among females and 8800 among males), many of which could be preventable with appropriate use of current or future vaccines.³

Two vaccines, a bivalent (HPV2) and a quadrivalent (HPV4) vaccine, are available to protect against HPV-16 and HPV-18.⁷ In addition, HPV4 protects against HPV-6 and HPV-11, which are responsible for 90% of genital warts.⁷ Both vaccines are administered as a 3-dose series. The Advisory Committee on Immunization Practices (ACIP) recommends routine vaccination of girls aged 11 to 12 years with either HPV2 or HPV4.⁸ The series can begin at age 9 years and is also recommended for females aged 13 to 26 years who have not initiated or completed the series. For boys aged 11 to 12 years, the ACIP recommends routine vaccination with HPV4.⁹ Vaccination with HPV4 for males can begin at age 9 years and is recommended for all males through age 21 years who have not initiated or completed

the series. HPV4 vaccination is also recommended for men who have sex with men or who are immunocompromised through age 26 years. Ideally, the vaccine should be administered before potential exposure to HPV through sexual contact.^{8,9}

Healthy People 2020 objectives include increasing HPV vaccine series completion for females aged 13 to 15 years to 80% by the year 2020.¹⁰ Since vaccine licensure in 2006, HPV vaccine coverage among US females has increased but remains low compared with other recommended adolescent vaccines. Data from the 2011 National Immunization Survey (NIS)-Teen indicated that 53.0% of US girls aged 13 to 17 years had received at least 1 dose of the HPV vaccine and 34.8% had completed the 3-dose series.¹¹ *Healthy People 2020* objectives do not address HPV vaccination among males, but vaccination of males is recommended to protect both males and their future sexual partners from HPV-related diseases.⁹ In 2011, 8.3% of US males aged 13 to 17 years had initiated the HPV vaccine series.¹¹ This article systematically reviews the literature on barriers to HPV vaccination among US adolescents, both males and females, to inform future efforts to increase HPV vaccine coverage.

Methods

We searched PubMed using the following search string: *human papillomavirus* OR *HPV* OR *human papillomavirus* AND (*vaccine* OR *vaccination* OR *vaccinate*). We limited the search to original research articles published in English from January 1, 2009, through December 31, 2012. One coauthor (D.M.H.) reviewed the titles and abstracts of all articles returned in the search and retrieved the full texts of potentially relevant articles to make a final determination of their relevance. The bibliographies of selected articles were scanned for additional relevant studies. Only articles that reported data collected in 2009 or later and addressed barriers to HPV vaccination among US adolescents aged 11 to 17 years were included. Articles that solely reported data collected before 2009 were excluded in an effort to focus on current barriers. Articles that focused on barriers to adult HPV vaccination or vaccination outside the United States were also excluded. One coauthor (D.M.H.) coded each article based on the target populations (eg, health care professionals, parents, and underserved populations) and topics (eg, completion and system-level barriers) addressed in the article. The coauthors (V.B., K.B.R., M.W., N.L., S.S.) then each abstracted and synthesized all findings related to a specific target population or topic. A second coauthor (D.M.H.) reviewed each section independently for accuracy. Disagreements were resolved by discussions among all the authors.

Results

The search in PubMed returned 2460 articles, of which 55 met the inclusion criteria. Findings are summarized in the Box and in the sections below by target populations: health care professionals, parents, underserved and disadvantaged populations, and males. The last section of the Results describes barriers to HPV vaccine series completion. Many articles reported quantitative data, but findings based solely on qualitative data are indicated as such within each section.

Health Care Professionals

Ten articles^{12–19,50,51} (18.2%) addressed barriers among health care professionals to vaccinating their patients. Two studies^{17,19} identified continuing knowledge gaps. For example, some studies^{17,19} indicated low knowledge among health care professionals about the relationship between HPV infection and genital warts or the relationship between HPV and noncervical cancers. Two qualitative studies (N = 60 and 184 respondents) indicated that, when offering the vaccine to patients, health care professionals either offered little information about the vaccine, treating it like other recommended adolescent vaccines, or provided detailed information about the risks and benefits of the vaccine, highlighting it as optional.^{50,51} In 3 qualitative studies (N = 31–184 respondents), health care professionals reported using a risk-based approach according to the perceived level of the patient's sexual activity or household characteristics⁵¹ and expressed a preference for vaccinating older vs younger adolescents⁵⁰ and girls vs boys.¹⁷

Three other qualitative studies^{13,15,18} (N = 8–112 respondents) found that the most common barriers for health care professionals related to financial concerns. These concerns included cost to parents,¹³ cost to health care professionals,¹³ and inadequate insurance coverage and reimbursement.¹⁸ A study¹⁴ of Florida Medicaid providers (N = 428) found that those participating in the Vaccines For Children (VFC) program were less likely to cite cost of stocking the vaccine and lack of adequate or timely reimbursement as barriers compared with non-VFC providers.

Several qualitative studies^{12,16–18} (N = 21–112 respondents) found that health care professionals thought the decision to vaccinate was beyond their control and cited parental attitudes and concerns as a barrier. Concerns about safety and efficacy were rarely identified as barriers.^{16,18} One qualitative study¹⁶ (N = 34) found that some health care professionals did not view HPV as an important health threat, whereas others cited time constraints and forgetting to offer the vaccine as additional barriers.

Parents and Caregivers

Most studies^{11,13,20–43,50,51,53–59} (63.6%) addressed the barriers experienced by parents and caregivers. Studies indicated that most parents were aware of the vaccine,^{31,39,54} but parents reported needing more information before vaccinating their children and cited lack of knowledge as a barrier.* In one qualitative study (N = 32),²⁹ parents reported that exposure to media and advertisement increased their knowledge and awareness of the vaccine. Some parents reported concerns about adverse effects, safety, and newness of the vaccine, but results were mixed as to whether such concerns hindered vaccine uptake.†

Across studies, few parents (1%–18%) expressed concern about the effect of vaccination on their child's sexual behavior.^{13,20,26,35,38,40,42} In a qualitative study³¹ among African Americans (n = 19) and Haitian immigrants (n = 51), parents reported concern about vaccination being interpreted as condoning sexual activity but also appreciation for the protection that the vaccine could provide. In another qualitative study (N = 44),⁴⁰ parents

*References 13, 20–22, 24, 28, 31, 32, 34, 35, 40, 43

†References 13, 21, 25, 26, 28, 33–35, 40, 42, 53, 54

reported concern about discussing the vaccine's purpose with their children, which might necessitate discussion about sexual activity. In 2 other qualitative studies (N = 32–38),^{29,43} parents indicated an interest in protecting their children before they became sexually active, and in many studies,^{21–24,29,34,50,55} perceived risk of HPV-related disease was a predictor of vaccine acceptance and series initiation.

Young age of the child was a common reason for refusing or delaying HPV vaccination,[‡] and older girls were more likely to be vaccinated than younger girls.^{11,20,22,23,28,30,34,56} Alternatively, in 2 studies (N = 403 and 700), age did not predict intention to vaccinate.^{54,58} Vaccine acceptance was also associated with the belief that vaccinating one's child was in accordance with social norms in 2 studies (N = 78 and 325).^{23,32} Furthermore, parents' history of seeking preventive care for themselves or their children was positively associated with HPV vaccine uptake.^{26,28,34,56,58} Results were mixed as to whether parents' previous HPV-related experiences (eg, prior abnormal Papanicolaou test, colposcopy, or cervical cancer) was correlated with acceptance of the HPV vaccine for one's child. One quantitative study⁵⁴ (N = 421) found that mothers with a history of HPV-related experiences were more likely to intend to vaccinate their daughters. Another study⁵⁹ (N = 150) found similar results among non-Hispanic white and black mothers but not Hispanic mothers. Alternatively, 3 other quantitative studies (N = 200–501) found no association between parents' HPV-related experiences and HPV vaccine acceptance or uptake.^{25,26,33} Two studies (N = 70 and 400) indicated certain religious affiliations were associated with opposition to or nonreceipt of the HPV vaccine.^{31,57} However, in 2 other studies (N = 200 and 403), religiosity did not predict vaccine acceptance.^{25,54}

Receiving a physician's recommendation or discussing the HPV vaccine with a physician was associated with vaccine acceptance and initiation in numerous studies,[§] and parents frequently cited not having a physician's recommendation as the reason for not vaccinating their child.^{22,28,33,34,43} Furthermore, preventive care visits,^{22,56} increased contact with the medical system,³⁷ and receipt of other recommended vaccines^{28,37} were associated with vaccine initiation in several studies. In contrast, only one study²⁶ (N = 322) found that a physician's consultation or recommendation did not influence vaccine uptake.

Findings were mixed regarding the cost of the HPV vaccine, with some identifying cost as a barrier^{13,26,33,35,38} and only one study (N = 403) indicating cost was not a barrier.⁵⁴ A study²⁰ among low-income, uninsured, ethnic minority, and immigrant women (N = 490) found that concerns about finding a clinic that offered the vaccine created additional barriers.

Underserved and Disadvantaged Populations

More than one-fourth (27.3%) of the studies^{||} addressed barriers among historically underserved populations (eg, minorities, those with a lower household income, and those without health insurance). Differences in HPV vaccine acceptance, initiation, and series

[‡]References 22, 26, 28, 34, 35, 38, 40, 50, 51

[§]References 13, 21–25, 27, 29–31, 36, 38, 41

^{||}References 11, 13, 20, 22, 28, 31, 34, 39–41, 44, 52, 58–60

completion have been noted across racial/ethnic groups.^{11,22,28,34,52} Recent data from NIS-Teen indicate that black and Hispanic girls are less likely to complete the HPV vaccine series compared with whites^{11,22,52} and may be less likely to receive a recommendation for the vaccine from a health care professional.⁴¹

Most reported barriers to vaccination are similar across racial/ethnic groups but may affect some groups more than others. For example, one study⁴⁴ (N = 309) that compared HPV vaccination among non-Hispanic white vs Hispanic girls found that the effects of age at first intercourse, mother-daughter communication about values related to sex, and social norms on vaccination status differed by ethnicity. In addition, a qualitative study⁴⁰ among ethnically diverse black women (N = 44) found limited knowledge and confusion about HPV and the vaccine. Cultural differences can create unique barriers for specific subpopulations. For example, a qualitative study¹³ of 12 Hispanic immigrants identified immigration status, cultural factors, and distrust of health care facilities as barriers, and a study³¹ of 70 African American and Haitian immigrant mothers found distinct barriers between the 2 groups.

Studies^{11,52} also indicate a possible association between HPV vaccination and both household income and health insurance coverage. Data from NIS-Teen indicate that the highest rates of HPV vaccine initiation are among adolescents from households below the federal poverty level. Another study²⁸ (N = 751) found that household income predicted vaccination initiation in boys only, with boys from homes with an annual household income of \$50 000 or more being less likely to be vaccinated than those with a lower income. With regard to insurance status, data from NIS-Teen and one other study (N = 479)^{22,39} indicated that girls with public health insurance were more likely to initiate HPV vaccination compared with girls with private or no insurance coverage. In contrast, 2 studies found no association between vaccination (N = 700)⁵⁸ or intent to vaccinate⁵⁹ (N = 150) and insurance status.

One study⁶⁰ (N = 50) described the unique barriers to vaccinating adolescents detained in juvenile justice facilities. Barriers included short length of stay, general lack of education regarding HPV vaccination, parental consent requirements, lack of adequate staff to administer the vaccine, staff reluctance to administer vaccine, lack of refrigerator storage space, patient fears, and cost.

Males

Eleven studies[#] (20.0%) examined barriers to male HPV vaccination. The NIS-Teen data indicate that uptake of the HPV vaccine is much lower among male adolescents than female adolescents.¹¹ Similar to females, rates of vaccine series initiation are higher among black and Hispanic males compared with white males and higher among males below the poverty level compared with males living at or above the poverty level.¹¹ Unlike females, HPV vaccine initiation does not vary with age among male adolescents,¹¹ and one qualitative study⁴⁰ among black women (N = 44) found mothers were more accepting of vaccinating sons at a young age than daughters. As mentioned previously, health care professionals may

[#]References 11, 17, 26, 28, 35, 36, 40, 45, 46, 61, 62

be more likely to recommend the vaccine to females than males.^{17,28} Furthermore, one qualitative study¹⁷ (N = 31) found that some health care professionals did not think vaccinating males was worth the cost or effort, were unaware of serious HPV-related disease in males, or thought that parents would not be interested in vaccinating their sons. Results from other studies indicated that parents were unclear about the need to vaccinate males,^{26,40} perceived the consequences of HPV infection as less severe for males,³⁵ or were unaware that the vaccine could be given to males.^{35,61,62} One mixed-methods study⁴⁶ among adolescent males (N = 86) found that participants did not think they were sufficiently informed to make a decision about vaccination on their own. Parents and sons were more accepting of the vaccine if they perceived greater benefits for their sons or their sons' future female partners,^{45,61,62} if their family or friends had positive views about the vaccine,^{46,62} or if the vaccine was recommended by a physician.^{36,46} Cost was also cited as a potential barrier to vaccinating males in one study (N = 406).⁶¹

Vaccine Series Completion

Ten studies^{11,22,33,37,47–49,63–65} (18.2%) addressed barriers to completion of the 3-dose HPV vaccine series. Studies indicated that rates of HPV vaccine series completion tended to be lower among black^{11,22,33,37,47,48,64} and Hispanic^{22,33} girls and lower among those who lacked insurance coverage,^{48,64,66} a regular medical home,⁴⁸ or a health care professional recommendation.³³

One small study⁶³ (N = 22) found some participants were unaware of or forgot the need for additional vaccine doses or were too busy for a return clinic visit. Another study³⁷ (N = 7702) found that increased contact with the medical system was associated with completion of the HPV vaccine series. Two retrospective cohort studies (N = 4117 and 271 976) found that younger adolescents were more likely to complete the series than older adolescents^{49,65} and that completion rates varied by physician specialty, with higher rates of completion rates in pediatric departments⁴⁹ and obstetrics-gynecology departments.⁶⁵

Discussion

Since vaccine licensure, HPV vaccine coverage among US adolescents has increased but remains low compared with coverage for other vaccines recommended for adolescents (eg, 70.5% coverage for meningococcal conjugate and 78.2% coverage for tetanus, diphtheria, and acellular pertussis in 2011).¹¹ This systematic review summarizes the literature on barriers to HPV vaccination among this age group and will inform future efforts to increase vaccine uptake. The literature emphasizes the importance of receiving a recommendation for HPV vaccination from a health care professional. Most health care professionals offer the HPV vaccine and support adolescent HPV vaccination. However, health care professionals tend to be less likely to recommend the vaccine to younger patients and often recommend the vaccine based on perceived risk. Continued efforts are needed to ensure that health care professionals understand the importance of vaccinating adolescents before they become sexually active. Health care professionals may benefit from guidance on communicating HPV vaccine recommendations to patients and parents. In addition, although health care professionals may be finding ways to overcome financial challenges, the barriers related to

vaccine cost should not be ignored. Some have suggested expanding or increasing health care professional participation in the VFC program as potential strategies for reducing financial barriers.^{14,67}

Parents are also critical to successful provision of the HPV vaccine. Parents want to protect their children from the harmful effects of HPV infection and are generally accepting of the vaccine. However, many report needing more information before vaccinating their children. Providing adequate, clear, and accessible information to parents about HPV infection, vaccine safety, adverse effects, and the appropriate age for vaccination may be one way health care professionals can reduce concerns and misconceptions about the vaccine. Communication efforts should also address logistical concerns (eg, vaccine financing).

Beliefs that only sexually active adolescents need the vaccine may lead parents to decline or delay HPV vaccination. Parents may underestimate their adolescents' sexual experience and potentially miss an opportunity for prevention.⁶⁸ Vaccinating at ages 11 or 12 years targets adolescents at an age when most are not yet sexually active and also when the immune response to vaccination is greater than it is at older ages.⁶⁹

Communication efforts are also needed to highlight the benefits and importance of male vaccination. Studying the barriers to vaccinating high-risk male adolescents may pose challenges because of the sensitive nature of some of the risk factors for HPV infection in male adolescents.

Targeted efforts are also needed to increase vaccine uptake and completion among traditionally underserved populations. For example, HPV vaccine initiation is higher among blacks than whites, but rates of series completion are lower for blacks than whites.¹¹ This disparity is concerning given that cervical cancer incidence and mortality are higher among black women than white women.⁷⁰ Series completion is lower among females living below the poverty level compared with females living at or above poverty level.¹¹ Information about the HPV vaccine should be distributed strategically to best reach underserved populations and provided in ways that are culturally sensitive, tailored to the target audience, and written at an appropriate reading level. School-based vaccination programs and health policy initiatives may further help to increase vaccine uptake and reduce disparities.⁴⁸

The need for 3 doses of the HPV vaccine creates additional challenges for parents.⁷¹ Adolescents generally encounter the health care system less frequently than any other age group⁷² and often seek only acute care or physical examinations for athletics.⁷³ Providing opportunities for HPV vaccination in less traditional health care settings (eg, pharmacies and retail health clinics) and using reminder and recall systems may facilitate vaccine series completion.⁷⁴ Innovative, communications-based interventions, including text message reminders and electronic medical records, may also increase series completion. However, such programs should take into account the specific populations they serve and consider that certain methods may not be effective for reaching underserved groups.^{63,75}

Although studies typically identify barriers to HPV vaccination via reports from individual parents and health care professionals, many of the barriers identified stem from system- or organizational-level factors. For example, health care professionals consistently cite poor

insurance coverage or reimbursement and cost to purchase and store the vaccine as barriers. Among parents, vaccine cost and lack of insurance coverage are commonly noted. Most studies do not directly examine variation in HPV vaccination initiation or series completion at the system or organizational level. Several commentaries in the literature discuss the system-level barriers that likely influence overall uptake, including consent and confidentiality issues for adolescents,^{76–79} cultural stigma associated with a vaccine for a sexually transmitted disease,^{80,81} no usual source of care and decreased preventive services for adolescents,^{76–79} and confusing societal norms that are unclear about adolescent autonomy and responsibility for sex and health care decisions.⁷⁷ All of these factors plausibly influence HPV vaccine uptake and should be considered when developing strategies to increase vaccine uptake and series completion. Multilevel analyses would be helpful for further understanding the role of system-level barriers on HPV vaccine uptake.

The literature search for this review yielded a large number of relevant studies, indicating that adolescent HPV vaccination is a high priority within public health and clinical communities. Despite the high volume of studies, study protocols and questionnaires varied widely. Use of standardized tools for collecting information about reasons for accepting or declining the HPV vaccine could facilitate more consistent data collection and enable researchers to more accurately compare barriers across groups and identify factors that facilitate HPV vaccination. One such tool is already available: the Carolina HPV Immunization Attitudes and Beliefs Scale provides standardized measures of parents' attitudes and beliefs about the HPV vaccine.⁸² A similar tool is needed for collecting data on the barriers faced by health care professionals.

This review provides a systematic and comprehensive summary of the barriers to HPV vaccination that have been identified in the literature. A limitation of this review was that several commentaries that described system-level barriers were initially captured in the literature search but were ultimately excluded because they did not include analyses of original data. The system-level barriers described in those commentaries were examined briefly in the Discussion section.

In conclusion, this review describes the barriers to US adolescent HPV vaccination that have been identified in the literature. Barriers faced by health care professionals and parents should be carefully considered when developing strategies to improve HPV vaccine uptake and completion. Efforts should also address the needs of traditionally underserved groups, with particular sensitivity to social and cultural differences and the financial and logistical challenges that may have a greater effect on uptake among certain groups. Ultimately, efforts to better understand and address system-level barriers and social determinants of vaccination could potentially increase HPV vaccine uptake and completion among all US adolescents.⁸³

REFERENCES

1. Dunne EF, Nielson CM, Stone KM, Markowitz LE, Giuliano AR. Prevalence of HPV infection among men. *J Infect Dis.* 2006; 194(8):1044–1057. [PubMed: 16991079]
2. Dunne EF, Sternberg M, Markowitz LE, et al. Human papillomavirus (HPV) 6, 11, 16, and 18 prevalence among females in the United States—National Health and Nutrition Examination Survey,

- 2003–2006: opportunity to measure HPV vaccine impact? *J Infect Dis.* 2011; 204(4):562–565. [PubMed: 21791658]
3. Centers for Disease Control and Prevention (CDC). [Accessed October 18, 2013] Human papillomavirus-associated cancers: how many cancers are linked with HPV each year?. <http://www.cdc.gov/cancer/hpv/statistics/cases.htm>.
 4. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Human papillomaviruses. *IARC Monogr Eval Carcinog Risks Hum.* 2007; 90:1–636. [PubMed: 18354839]
 5. Gillison ML, Chaturvedi AK, Lowy DR. HPV prophylactic vaccines and the potential prevention of noncervical cancers in both men and women. *Cancer.* 2008; 113 suppl(10):3036–3046. [PubMed: 18980286]
 6. Hariri S, Unger ER, Sternberg M, et al. Prevalence of genital human papillomavirus among females in the United States, the National Health and Nutrition Examination Survey, 2003–2006. *J Infect Dis.* 2011; 204(4):566–573. [PubMed: 21791659]
 7. Centers for Disease Control and Prevention (CDC). National and state vaccination coverage among adolescents aged 13 through 17 years—United States, 2010. *MMWR Morb Mortal Wkly Rep.* 2011; 60(33):1117–1123. [PubMed: 21866084]
 8. Centers for Disease Control and Prevention (CDC). FDA licensure of bivalent human papillomavirus vaccine (HPV2, Cervarix) for use in females and updated HPV vaccination recommendations from the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep.* 2010; 59(20):626–629. [PubMed: 20508593]
 9. Centers for Disease Control and Prevention (CDC). Recommendations on the use of quadrivalent human papillomavirus vaccine in males—Advisory Committee on Immunization Practices (ACIP), 2011. *MMWR Morb Mortal Wkly Rep.* 2011; 60(50):1705–1708. [PubMed: 22189893]
 10. US Department of Health and Human Services. [Accessed May 29, 2012] Immunization and Infectious Diseases. Healthy People 2020 Topics & Objectives May 18, 2012. <http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=23>.
 11. Centers for Disease Control and Prevention (CDC). National and state vaccination coverage among adolescents aged 13–17 years—United States, 2011. *MMWR Morb Mortal Wkly Rep.* 2012; 61(34):671–677. [PubMed: 22932301]
 12. Javanbakht M, Stahlman S, Walker S, et al. Provider perceptions of barriers and facilitators of HPV vaccination in a high-risk community. *Vaccine.* 2012; 30(30):4511–4516. [PubMed: 22561142]
 13. Luque JS, Raychowdhury S, Weaver M. Health care provider challenges for reaching Hispanic immigrants with HPV vaccination in rural Georgia. *Rural Remote Health.* 2012; 12(2):1975. [PubMed: 22537411]
 14. Malo TL, Hassani D, Staras SA, Shenkman EA, Giuliano AR, Vadaparampil ST. Do Florida Medicaid providers' barriers to HPV vaccination vary based on VFC program participation? *Matern Child Health J.* 2013; 17(4):609–615. [PubMed: 22569945]
 15. Meites E, Llada E, Hariri S, et al. HPV vaccine implementation in STD clinics: STD Surveillance Network. *Sex Transm Dis.* 2012; 39(1):32–34. [PubMed: 22183843]
 16. Perkins RB, Clark JA. What affects human papillomavirus vaccination rates? a qualitative analysis of providers' perceptions. *Womens Health Issues.* 2012; 22(4):e379–e386. [PubMed: 22609253]
 17. Perkins RB, Clark JA. Providers' attitudes toward human papillomavirus vaccination in young men: challenges for implementation of 2011 recommendations. *Am J Mens Health.* 2012; 6(4):320–323. [PubMed: 22398992]
 18. Quinn GP, Murphy D, Malo TL, Christie J, Vadaparampil ST. A national survey about human papillomavirus vaccination: what we didn't ask, but physicians wanted us to know. *J Pediatr Adolesc Gynecol.* 2012; 25(4):254–258. [PubMed: 22516792]
 19. Saraiya M, Rosser JI, Cooper CP. Cancers that U.S. physicians believe the HPV vaccine prevents. *J Womens Health (Larchmt).* 2012; 21(2):111–117. [PubMed: 22216920]
 20. Bastani R, Glenn BA, Tsui J, et al. Understanding suboptimal human papillomavirus vaccine uptake among ethnic minority girls. *Cancer Epidemiol Biomarkers Prev.* 2011; 20(7):1463–1472. [PubMed: 21602307]

21. Dorell C, Yankey D, Strasser S. Parent-reported reasons for nonreceipt of recommended adolescent vaccinations, National Immunization Survey: Teen, 2009. *Clin Pediatr (Phila)*. 2011; 50(12):1116–1124. [PubMed: 21856964]
22. Dorell CG, Yankey D, Santibanez TA, Markowitz LE. Human papillomavirus vaccination series initiation and completion, 2008–2009 [published correction appears in *Pediatrics*. 2012;130(1):166–168]. *Pediatrics*. 2011; 128(5):830–839. [PubMed: 22007006]
23. Reynolds D, O'Connell KA. Testing a model for parental acceptance of human papillomavirus vaccine in 9- to 18-year-old girls: a theory-guided study. *J Pediatr Nurs*. 2012; 27(6):614–625. [PubMed: 22020360]
24. Stokley S, Cohn A, Dorell C, et al. Adolescent vaccination-coverage levels in the United States: 2006–2009. *Pediatrics*. 2011; 128(6):1078–1086. [PubMed: 22084326]
25. Thompson VL, Arnold LD, Notaro SR. African American parents' attitudes toward HPV vaccination. *Ethn Dis*. 2011; 21(3):335–341. [PubMed: 21942167]
26. Berenson AB, Rahman M. Gender differences among low income women in their intent to vaccinate their sons and daughters against human papillomavirus infection. *J Pediatr Adolesc Gynecol*. 2012; 25(3):218–220. [PubMed: 22578484]
27. Dorell C, Yankey D, Kennedy A, Stokley S. Factors that influence parental vaccination decisions for adolescents, 13 to 17 years old: National Immunization Survey-Teen, 2010. *Clin Pediatr (Phila)*. 2013; 52(2):162–170. [PubMed: 23221308]
28. Gilkey MB, Moss JL, McRee AL, Brewer NT. Do correlates of HPV vaccine initiation differ between adolescent boys and girls? *Vaccine*. 2012; 30(41):5928–5934. [PubMed: 22841973]
29. Griffioen AM, Glynn S, Mullins TK, et al. Perspectives on decision making about human papillomavirus vaccination among 11- to 12-year-old girls and their mothers. *Clin Pediatr (Phila)*. 2012; 51(6):560–568. [PubMed: 22589477]
30. Hoffman L, Okcu MF, Dreyer ZE, Suzawa H, Bryant R, Middleman AB. Human papillomavirus vaccination in female pediatric cancer survivors. *J Pediatr Adolesc Gynecol*. 2012; 25(5):305–307. [PubMed: 22831900]
31. Joseph NP, Clark JA, Bauchner H, et al. Knowledge, attitudes, and beliefs regarding HPV vaccination: ethnic and cultural differences between African-American and Haitian immigrant women. *Womens Health Issues*. 2012; 22(6):e571–e579. [PubMed: 23122214]
32. Kepka DL, Ulrich AK, Coronado GD. Low knowledge of the three-dose HPV vaccine series among mothers of rural Hispanic adolescents. *J Health Care Poor Underserved*. 2012; 23(2):626–635. [PubMed: 22643612]
33. Kester LM, Zimet GD, Fortenberry JD, Kahn JA, Shew ML. A national study of HPV vaccination of adolescent girls: rates, predictors, and reasons for non-vaccination. *Matern Child Health J*. 2013; 17(5):879–885. [PubMed: 22729660]
34. Laz TH, Rahman M, Berenson AB. An update on human papillomavirus vaccine uptake among 11–17 year old girls in the United States: National Health Interview Survey, 2010. *Vaccine*. 2012; 30(24):3534–3540. [PubMed: 22480927]
35. Oldach BR, Katz ML. Ohio Appalachia public health department personnel: human papillomavirus (HPV) vaccine availability, and acceptance and concerns among parents of male and female adolescents. *J Community Health*. 2012; 37(6):1157–1163. [PubMed: 22968822]
36. Perkins RB, Apte G, Marquez C, et al. Factors affecting human papillomavirus vaccine utilization among white, black, and Latino parents of sons. *Pediatr Infect Dis J*. 2013; 32(1):e38–e44. [PubMed: 22914585]
37. Perkins RB, Brogly SB, Adams WG, Freund KM. Correlates of human papillomavirus vaccination rates in low-income, minority adolescents: a multicenter study. *J Womens Health (Larchmt)*. 2012; 21(8):813–820. [PubMed: 22860770]
38. Sanders Thompson VL, Arnold LD, Notaro SR. African American parents' HPV vaccination intent and concerns. *J Health Care Poor Underserved*. 2012; 23(1):290–301. [PubMed: 22643477]
39. Tsui J, Gee GC, Rodriguez HP, et al. Exploring the role of neighborhood socio-demographic factors on HPV vaccine initiation among low-income, ethnic minority girls. *J Immigr Minor Health*. 2013; 15(4):732–740. [PubMed: 23081659]

40. Wilson R, Brown DR, Boothe MA, Harris CE. Knowledge and acceptability of the HPV vaccine among ethnically diverse black women. *J Immigr Minor Health*. 2013; 15(4):747–757. [PubMed: 23197180]
41. Ylitalo KR, Lee H, Mehta NK. Health care provider recommendation, human papillomavirus vaccination, and race/ethnicity in the US National Immunization Survey. *Am J Public Health*. 2012; 103(1):164–169. [PubMed: 22698055]
42. Lechuga J, Swain G, Weinhardt LS. Perceived need of a parental decision aid for the HPV vaccine: content and format preferences. *Health Promot Pract*. 2012; 13(2):214–221. [PubMed: 21444922]
43. Hamlish T, Clarke L, Alexander KA. Barriers to HPV immunization for African American adolescent females. *Vaccine*. 2012; 30(45):6472–6476. [PubMed: 22910288]
44. Reimer RA, Houlihan AE, Gerrard M, Deer MM, Lund AJ. Ethnic differences in predictors of HPV vaccination: comparisons of predictors for Latina and non-Latina white women. *J Sex Res*. [published online October, 2, 2012].
45. Dempsey AF, Butchart A, Singer D, Clark S, Davis M. Factors associated with parental intentions for male human papillomavirus vaccination: results of a national survey. *Sex Transm Dis*. 2011; 38(8):769–776. [PubMed: 21336230]
46. Gutierrez B Jr, Leung A, Jones KT, et al. Acceptability of the human papillomavirus vaccine among urban adolescent males. *Am J Mens Health*. 2013; 7(1):27–36. [PubMed: 22892147]
47. Schluterman NH, Terplan M, Lydecker AD, Tracy JK. Human papillomavirus (HPV) vaccine uptake and completion at an urban hospital. *Vaccine*. 2011; 29(21):3767–3772. [PubMed: 21440038]
48. Tan W, Viera AJ, Rowe-West B, Grimshaw A, Quinn B, Walter EB. The HPV vaccine: are dosing recommendations being followed? *Vaccine*. 2011; 29(14):2548–2554. [PubMed: 21300098]
49. Rubin RF, Kuttub HM, Rihani RS, Reutzel TJ. Patient adherence to three dose completion of the quadrivalent human papillomavirus (HPV) vaccine in a private practice. *J Community Health*. 2012; 37(6):1145–1150. [PubMed: 22752532]
50. Goff SL, Mazor KM, Gagne SJ, Corey KC, Blake DR. Vaccine counseling: a content analysis of patient-physician discussions regarding human papillomavirus vaccine. *Vaccine*. 2011; 29(43):7343–7349. [PubMed: 21839136]
51. Hughes CC, Jones AL, Feemster KA, Fiks AG. HPV vaccine decision making in pediatric primary care: a semi-structured interview study. *BMC Pediatr*. 2011; 11:74. [PubMed: 21878128]
52. Centers for Disease Control and Prevention (CDC). National, state, and local area vaccination coverage among adolescents aged 13–17 years—United States, 2009. *MMWR Morb Mortal Wkly Rep*. 2010; 59(32):1018–1023. [PubMed: 20724968]
53. Freed GL, Clark SJ, Butchart AT, Singer DC, Davis MM. Parental vaccine safety concerns in 2009. *Pediatrics*. 2010; 125(4):654–659. [PubMed: 20194286]
54. Litton AG, Desmond RA, Gilliland J, Huh WK, Franklin FA. Factors associated with intention to vaccinate a daughter against HPV: a statewide survey in Alabama. *J Pediatr Adolesc Gynecol*. 2011; 24(3):166–171. [PubMed: 21397534]
55. Baldwin AS, Bruce CM, Tiro JA. Understanding how mothers of adolescent girls obtain information about the HPV vaccine. *J Health Psychol*. 2013; 18(7):926–938. [PubMed: 22992585]
56. Moss JL, Gilkey MB, Reiter PL, Brewer NT. Trends in HPV vaccine initiation among adolescent females in North Carolina, 2008–2010. *Cancer Epidemiol Biomarkers Prev*. 2012; 21(11):1913–1922. [PubMed: 23001239]
57. Thomas TL, Strickland OL, DiClemente R, Higgins M, Haber M. Rural African American parents' knowledge and decisions about human papillomavirus vaccination. *J Nurs Scholarsh*. 2012; 44(4):358–367. [PubMed: 23126428]
58. Tiro JA, Pruitt SL, Bruce CM, et al. Multilevel correlates for human papillomavirus vaccination of adolescent girls attending safety net clinics. *Vaccine*. 2012; 30(13):2368–2375. [PubMed: 22108490]
59. Lechuga J, Swain GR, Weinhardt LS. The cross-cultural variation of predictors of human papillomavirus vaccination intentions. *J Womens Health (Larchmt)*. 2011; 20(2):225–230. [PubMed: 21314448]

60. Henderson CE, Rich JD, Lally MA. HPV vaccination practices among juvenile justice facilities in the United States. *J Adolesc Health*. 2010; 46(5):495–498. [PubMed: 20413087]
61. Reiter PL, McRee AL, Gottlieb SL, Brewer NT. HPV vaccine for adolescent males: acceptability to parents post-vaccine licensure. *Vaccine*. 2010; 28(38):6292–6297. [PubMed: 20637770]
62. Reiter PL, McRee AL, Kadis JA, Brewer NT. HPV vaccine and adolescent males. *Vaccine*. 2011; 29(34):5595–5602. [PubMed: 21704104]
63. Kouyoumdjian FG, Bailowitz A. Completion of the human papillomavirus vaccine series in females attending an urban immunization clinic. *Pediatr Infect Dis J*. 2011; 30(8):718–719. [PubMed: 21343841]
64. Widdice LE, Bernstein DI, Leonard AC, Marsolo KA, Kahn JA. Adherence to the HPV vaccine dosing intervals and factors associated with completion of 3 doses. *Pediatrics*. 2011; 127(1):77–84. [PubMed: 21149425]
65. Hirth JM, Tan A, Wilkinson GS, Berenson AB. Completion of the human papillomavirus vaccine series among insured females between 2006 and 2009. *Cancer*. 2012; 118(22):5623–5629. [PubMed: 22544681]
66. Dempsey A, Cohn L, Dalton V, Ruffin M. Patient and clinic factors associated with adolescent human papillomavirus vaccine utilization within a university-based health system. *Vaccine*. 2010; 28(4):989–995. [PubMed: 19925899]
67. Gowda C, Dempsey AF. Medicaid reimbursement and the uptake of adolescent vaccines. *Vaccine*. 2012; 30(9):1682–1689. [PubMed: 22226859]
68. Mollborn S, Everett B. Correlates and consequences of parent-teen incongruence in reports of teens' sexual experience. *J Sex Res*. 2010; 47(4):314–329. [PubMed: 19431037]
69. Block SL, Nolan T, Sattler C, et al. Protocol 016 Study Group. Comparison of the immunogenicity and reactogenicity of a prophylactic quadrivalent human papillomavirus (types 6, 11, 16, and 18) L1 virus-like particle vaccine in male and female adolescents and young adult women. *Pediatrics*. 2006; 118(5):2135–2145. [PubMed: 17079588]
70. Watson M, Saraiya M, Benard V, et al. Burden of cervical cancer in the United States, 1998–2003. *Cancer*. 2008; 113 suppl(10):2855–2864. [PubMed: 18980204]
71. Rand CM, Szilagyi PG, Albertin C, Auinger P. Additional health care visits needed among adolescents for human papillomavirus vaccine delivery within medical homes: a national study. *Pediatrics*. 2007; 120(3):461–466. [PubMed: 17766516]
72. Woodwell DA, Cherry DK. National Ambulatory Medical Care Survey: 2002 summary. *Adv Data*. 2004; (346):1–44. [PubMed: 15460863]
73. Humiston SG, Rosenthal SL. Challenges to vaccinating adolescents: vaccine implementation issues. *Pediatr Infect Dis J*. 2005; 24 suppl(6):S134–S140. [PubMed: 15931141]
74. Suh CA, Saville A, Daley MF, et al. Effectiveness and net cost of reminder/recall for adolescent immunizations. *Pediatrics*. 2012; 129(6):e1437–e1445. [PubMed: 22566415]
75. Kontos EZ, Emmons KM, Puleo E, Viswanath K. Contribution of communication inequalities to disparities in human papillomavirus vaccine awareness and knowledge. *Am J Public Health*. 2012; 102(10):1911–1920. [PubMed: 22970692]
76. Edwards SM, Rousseau-Pierre T. Immunizations in adolescents: an update. *Adolesc Med State Art Rev*. 2010; 21(2):173–186. vii. [PubMed: 21047023]
77. Farrell RM, Rome ES. Adolescents' access and consent to the human papillomavirus vaccine. *Pediatrics*. 2007; 120(2):434–437. [PubMed: 17671069]
78. Hershey JH, Velez LF. Public health issues related to HPV vaccination. *J Public Health Manag Pract*. 2009; 15(5):384–392. [PubMed: 19704306]
79. Vetter KM, Geller SE. Moving forward: human papillomavirus vaccination and the prevention of cervical cancer. *J Womens Health (Larchmt)*. 2007; 16(9):1258–1268. [PubMed: 18001182]
80. Fisher JW, Brundage SI. The challenge of eliminating cervical cancer in the United States. *Women Health*. 2009; 49(2–3):246–261. [PubMed: 19533513]
81. Lehmann C, Benson PA. Vaccine adherence in adolescents. *Clin Pediatr (Phila)*. 2009; 48(8):801–811. [PubMed: 19483127]

82. McRee AL, Brewer NT, Reiter PL, Gottlieb SL, Smith JS. The Carolina HPV immunization attitudes and beliefs scale (CHIAS): scale development and associations with intentions to vaccinate. *Sex Transm Dis.* 2010; 37(4):234–239. [PubMed: 19940807]
83. Frieden TR. A framework for public health action: the health impact pyramid. *Am J Public Health.* 2010; 100(4):590–595. [PubMed: 20167880]

Box**Summary of Key Barriers to HPV Vaccination Among US Adolescents^a****Health Care Professionals**

Parents' attitudes and concerns regarding HPV vaccination^{12,16–18}

Financial concerns^{13,15,18}

Knowledge gaps^{17,19}

Inadequate insurance coverage and reimbursement^{14,18}

Preference for vaccinating older vs younger adolescents⁵⁰

Preference for vaccinating girls vs boys¹⁷

Parents

Not receiving a health care professional's recommendation for the HPV vaccine^b

Need more information about the HPV vaccine^c

Belief that one's child is too young to get vaccinated for HPV^d

Concerns about vaccine adverse effects, safety, and newness^e

Cost of the HPV vaccine^f

Concerns about finding a clinic that offers the HPV vaccine²⁰

Underserved and Disadvantaged Populations

Limited knowledge about HPV and the HPV vaccine^{40,52}

Lack of insurance coverage^{22,39}

Not Receiving a Health Care Professional's Recommendation for the HPV Vaccine⁴¹

Distrust of the health care system¹³

Cultural factors¹³

Immigration status¹³

Males

Lack of perceived benefit or need to vaccinate males^{17,26,35,40}

Lack of awareness that vaccine can be given to males^{35,44,45}

Not receiving a health care professional's recommendation for the HPV vaccine^{17,28}

Cost of the vaccine⁴⁴

Barriers Specific to Completion of the 3-Dose HPV Vaccine Series

Lack of insurance coverage^{47–49}

Lack of a regular medical home⁴⁷

Lack of a health care professional recommendation³³

Little contact with the medical system³⁷

Being unaware of or forgetting about the need for additional doses⁴⁶

Abbreviation: HPV, human papillomavirus.

^a Review limited to original research studies reporting data collected in 2009 or later.

^b References 13,21–25,27–31,33,34,36,38,41,43

^c References 13,20–22,24,28,31,32,34,35,40,43

^d References 22,26,28,34,35,38,40,50,51

^e References 13,20,26,35,38,40,42

^f References 13,26,31,35,38